

## TITLE

### SNAP-ON SCREW-OFF CLOSURE

*For use in combination with a container*

### CROSS-REFERENCE

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This application is a continuation-in-part (CIP) of U.S. Patent Application Serial No.  
5 08/961,440 filed October 30, 1997, the disclosure of which is incorporated herein by  
reference.

## FIELD OF THE INVENTION

The present invention relates to a closure and neck finish for blow-molded containers  
and in particular to a snap-on closure with a tamper evident locking feature that can be  
10 screwed off the container after initial application and then reapplied by screwing the closure  
onto the container.

## RELATED APPLICATIONS

One family of related patent applications assigned to the assignee of the present  
application include U.S. Patent Application Serial No. 09/067,583 filed April 28, 1998,  
15 which is a continuation-in-part of U.S. Patent Application Serial No. 08/948,342 filed  
October 8, 1997, which is a continuation-in-part of U.S. Patent Application Serial No.  
08/927,311 filed September 11, 1997, which is a continuation-in-part of U.S. Patent  
Application Serial No. 08/749,488 filed on November 15, 1996, which is a continuation-in-  
part of U.S. Patent Application Serial No. 08/603,148 filed on February 15, 1996. Another  
20 family of related patent applications assigned to the assignee of the present application  
include U.S. Patent Application Serial No. 08/927,743 filed September 11, 1997, which is

a continuation-in-part of U.S. Patent Application Serial No. 08/838,133 filed on April 15, 1997, which is a continuation-in-part of U.S. Patent Application Serial No. 08/687,149 filed on July 24, 1996, which is a continuation-in-part of U.S. Patent Application Serial No. 08/633,225 filed on April 16, 1996.

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## BACKGROUND OF THE INVENTION

Tamper evident caps for containers, such as blow-molded or injection molded containers are well known, see e.g., U.S. Patent Nos. 4,561,553, 4,625,875, 4,497,765, and 4,534,480. A number of caps are of the snap-on screw-off variety such as U.S. Patent Nos. 5,553,727, 5,190,178, 5,213,224, 5,267,661, 5,285,912, 5,480,045, 5,456,376, and 10 5,307,946 and 5,560,504. Generally, the prior art caps include a spiral thread or threads which match a spiral thread on the neck of the bottle. In U.S. Patent No. 5,307,946 the cap and bottle neck include a seven lead-in end annular spiral thread configuration (or fastening means) and in U.S. Patent No. 5,553,727 the cap and bottle neck include a ten lead-in end annular spiral thread configuration (or fastening means). The advantage of the multiple 15 lead-in threads is the increased ease of "snap-on" placement of the cap onto the threaded neck using standard bottle capping equipment and without an additional tightening step such as a final twist.

As is apparent from the prior art patents, a great deal of effort has gone into design of cap and bottle neck configurations to provide easy on and off use of the cap by the bottler 20 and ultimately by the end user of the bottled product. However, notwithstanding this effort,

the bottling industry continues to search for a cap and neck finish which achieves these objectives but which also provides a secure seal.

The present invention solves this problem by optionally providing at least one annular sealing bead depending from the outer surface of the closure valve which are compressed  
5 against the inner surface of the container neck to form a seal as the closure is snapped onto the container neck. Optionally, sealing engagement between the closure and the mating portions of the exterior wall of the container neck may be further improved by including one or more annular sealing beads on the interior surface of the closure depending annular skirt.

The present invention also solves the problem of protecting the integrity of frangible  
10 elements during installation of threaded tamper-evident closures. A plurality of elevated areas extend upwardly from the tamper-evident band in spaced relation to the bottom edge of the closure body. The purpose of these elevated areas is to support the tamper evident band in resisting vertical movement imparted by insertion of the closure on the bottle neck, thereby protecting the frangible elements during assembly. The frangible elements  
15 connecting the tamper-evident band to the lower edge of the closure body may be configured to extend from these elevated areas as well as the non-elevated areas of the tamper-evident band. The purpose of attaching frangible elements to the elevated areas of the tamper-evident band is to assist in preventing axial misalignment of the tamper-evident band relative to the annular depending skirt portion of the closure upon subjecting the closure to torquing  
20 forces during assembly to the container neck.

At least one and preferably a plurality of circumferentially spaced lugs optionally extend from the exterior wall of the container neck. These lugs facilitate breaking the

frangible elements on the tamper-evident band of the closure by engaging the frangible elements as the closure is twisted off the container neck following initial snap-on application.

Additionally, the tamper indicating closure may include at least one arcuate projection extending around at least a portion of the tamper indicating ring arranged for registration  
5 with an annular locking flange on a container neck portion on which the closure is positioned. The closure is provided with at least one member attached to the tamper-indicating ring which cooperates with the arcuate projection to assist in breaking the tamper indicating ring during removal of the closure from the container neck. The arcuate projection is held in place by the locking flange on the container neck as the member is  
10 pulled away from the arcuate projection during twist-off removal of the closure body to cause the tamper indicating ring to break at a weakened area.

Accordingly, it is an object of the present invention to improve sealing engagement between the closure and the mating portions of the interior wall of the container neck by including at least one annular sealing bead depending from the outer surface of the closure  
15 valve which are compressed against the inner surface of the container neck to form a seal as the closure is snapped onto the container neck.

It is a further object of the present invention to improve sealing engagement between the closure and the mating portions of the exterior wall of the container neck by including one or more annular sealing beads on the interior surface of the closure depending annular  
20 skirt.

It is a further object of the present invention to provide a lug configuration for facilitating the breakage of frangible elements on the tamper evident band of the closure.

It is a further object of the present invention to provide a threaded tamper-evident closure having frangible elements attached from and between a plurality of elevated areas extending upwardly from the tamper-evident band, for protecting the integrity of frangible elements during installation of the closure on a bottle neck.

5 It is a further object of the present invention to provide a closure with at least one member attached to the tamper-indicating ring which cooperates with the arcuate projection to assist in breaking the tamper indicating ring during removal of the closure from the container neck.

#### SUMMARY OF THE INVENTION

10 The present invention provides a closure with a thread configuration adapted for snap-on or screw-on application to a container neck finish. Preferably the closure and neck finish contain eight or nine mating continuous or discontinuous threads for this purpose.

The present invention preferably provides at least one annular sealing bead depending from the outer surface of the closure <sup>inner annular sealing flange</sup> ~~valve~~ which are compressed against the inner surface  
15 of the container neck to form a seal as the closure is snapped onto the container neck. Optionally, sealing engagement between the closure and the mating portions of the exterior wall of the container neck may be further improved by including one or more annular sealing beads on the interior surface of the closure depending annular skirt.

The present invention also preferably provides plurality of elevated areas extend  
20 upwardly from the tamper-evident band in spaced relation to the bottom edge of the closure body to support the tamper evident band in resisting vertical movement imparted by insertion

of the closure on the bottle neck, thereby protecting the frangible elements during assembly. The frangible elements connecting the tamper-evident band to the lower edge of the closure body may be configured to extend from these elevated areas as well as the non-elevated areas of the tamper-evident band to assist in preventing axial misalignment of the tamper-evident band relative to the annular depending skirt portion of the closure upon subjecting the closure to torquing forces during assembly to the container neck.

Additionally, the tamper indicating closure may include at least one arcuate projection extending around at least a portion of the tamper indicating ring arranged for registration with an annular locking flange on a container neck portion on which the closure is positioned. The closure is optionally provided with at least one member attached to the tamper-indicating ring which cooperates with the arcuate projection to assist in breaking the tamper indicating ring during removal of the closure from the container neck. The arcuate projection is held in place by the container neck as the member is pulled away from the arcuate projection during twist-off removal of the closure body to cause the tamper indicating ring to break at a weakened area.

At least one and preferably a plurality of circumferentially spaced lugs optionally extend from the exterior wall of the container neck to facilitate breaking the frangible elements on the tamper-evident band of the closure by engaging the frangible elements as the closure is twisted off the container neck following initial snap-on application.

Other advantages of the present invention will become apparent by a perusal of the following detailed description of a presently preferred embodiment of the invention taken in connection with the drawings.

## BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is an elevation in partial section of a bottle neck finish and closure according to the present invention;

Figure 1A is an enlarged view of the circumferential mating engagement of the closure and container neck shown in Figure 1;

Figures 2 and 2A are enlarged sectional views of the tamper-evident band of the closure of the present invention;

Figure 3 is a sectional view of the closure sealing valve as it is attached to the closure of the present invention;

Figure 4 is an exploded view of the arcuate locking projection of the present invention; and

Figure 5 is a plan view of the closure showing the cooperation of the arcuate locking projection with a member extending from the closure body to facilitate breaking the tamper-evident band.

## DETAILED DESCRIPTION OF THE PRESENTLY PREFERRED EMBODIMENT

Referring to Figures 1 and 1A, the neck finish 10 of a container 11 is partially shown. Neck finish 10 is preferably made of plastic and more preferably a high density plastic suitable for blow molding manufacture of the neck finish 10. Neck finish 10 includes an annular wall 12 having a first end 14 and a second end 16 and defining a cylindrical opening 13 within the neck finish 10, with first end 14 providing access to opening 13.

Positioned adjacent to second end 16 is at least one and preferably a plurality of circumferentially spaced lugs 18<sup>projecting</sup> ~~extend~~ from the exterior wall of the container neck. Lugs 18 may be preferably positioned around the entire circumference of the annular wall 12 or alternately only a portion thereof. Lugs 18 facilitate breaking the frangible elements on the tamper-evident band 34 of the closure 30 by engaging frangible elements 35 connecting the tamper-evident band 34 to the closure 30 as the closure 30 is twisted off the container neck 10 following initial snap-on application of the closure 30.

Helically extending between first end 14 and the second end 16 of the annular wall 12 are an appropriate number of threads to permit snap-on or screw-on application, preferably eight or nine threads 24 terminating at points 26 and 27 proximate to the first end 14 and second end 16 of annular wall 12, respectively. Preferably, threads 24 are helically spaced in a continuous relationship as shown in Figure 1 but threads 24 can alternately be discontinuous and can take on any cross-sectional profile suitable for mating with threads 43 on the closure 30 during snap and screw-on application of the closure 30 to the neck finish 10.

Closure 30 is preferably made from a low or high density polypropylene suitable for blow molding manufacturing. Cap 30 comprises a closure member 31 designed to cover the cylindrical opening 13 of the container neck finish 10. In a preferred embodiment of the invention, closure member 31 is substantially circular and an annular wall 32 circumferentially surrounding at least a portion of neck finish 10 depends from closure member 31.



Annular wall 32 includes a tamper-evident band 34 around the end opposite the closure member 31. Tamper-evident band 34 includes at least one and preferably a plurality of frangible elements 35 extending around at least a portion of the circumference of the tamper-evident band 34. As shown in Figures 2 and 2A, at least one and preferably a plurality of elevated areas 36 extend upwardly from the tamper-evident band 34 in spaced relation to the bottom edge of annular wall 32. The purpose of these elevated areas is to support the tamper evident band 34 in resisting vertical movement imparted by insertion of the closure on the bottle neck, thereby protecting the frangible elements 35 during assembly.

a As shown in Figure 2, the frangible elements 35a connecting the tamper-evident band 34 to the lower edge of annular wall 32 may be configured to extend from these elevated areas 36 as well as from the non-elevated areas of the tamper-evident band 34. The purpose of attaching frangible elements to the elevated areas 36 of the tamper-evident band 34 is to assist in preventing axial misalignment of the tamper-evident band 34 relative to the annular wall portion 32 of the closure 30 upon subjecting the closure 30 to torquing forces during snap-on assembly to the container neck finish 10.

Optionally, tamper-evident band 34 may be configured with at least one or more arcuate flanged locking projections 37 circumferentially spaced about the inner surface of the tamper evident ring 34 and positioned so that they are engageable under an annular locking flange on a bottle neck (not shown) to lock the closure 30 on the bottle neck. As can be seen in Figure 4, arcuate projections 37 can comprise edges 37a defining grooves 37b formed on radially upwardly extending annular flanges 37c. Flanges 37c can be discontinuous or continuous. Edge 37a and groove 37b provide a "hook" shape for engaging

the annular locking flange on the container neck (not shown) which has a radius substantially the same as groove 37b. The surface of flange 37c may lie at an angle with a plane normal to the inner surface of the tamper-evident band 34, thereby defining a grooved "hook" with a reverse basis allowing flange 37c to slide over the locking flange on the bottle neck when the closure is placed on the container but which engages and locks the closure to the container when removal of the closure is attempted with the tamper-evident band 34 intact. The aforementioned angle may vary over the surface of flange 37c such that at least a portion of the flange surface lies substantially parallel to the interior surface of the tamper indicating band 34. This flanged edge and groove configuration 37a-37c may be positioned at any elevation the surface of tamper-evident band 34, including a position adjacent to the bottom edge of tamper-evident band 34 as shown in Figure 4. ~~in~~ Because groove 37b is undercut, a mold core must be used that frees or permits removal of undercut prior to stripping the closures from the mold. Various techniques are known to those skilled in the art including the use of movable core sleeves which free the undercut section of the mold.

As shown in Figure 5, tamper-evident band 34 is also attached to a member 40 extending from annular wall 32 to facilitate breaking the tamper-evident band 34 when unscrewing the closure 30 to remove it from the neck finish 10 of the container 11. Preferably member 40 is also attached to the tamper-evident band 34 by a strip 41 of material extending between member 40 and tamper-evident band 34 and located proximate to a weakened area 42 formed in the tamper evident band 34. The unscrewing of the closure 30 from the container neck finish 10 produces an upward force on the member 40 which is translated through strip 41 to the attached portion B of the tamper-evident band 34. This

upward force acts in concert with a downward force exerted by interference between the container neck finish 10 and the portion A of the tamper-evident band 34 containing arcuate flange 37 to cause the weakened area 42 to rupture, thereby breaking the tamper-evident band 34 to allow the closure 30 to be removed from the container 11. The tamper-evident band 34 will remain with the closure 30 due to the strip 41 attaching the member 40 to the tamper-evident band 34. Strip 41 can subsequently be completely broken away to allow removal of the tamper-evident band 34 from the closure 30.

Extending from a location proximate to closure member 31 to a location proximate to tamper-evident band 35 are an appropriate number of threads to permit snap-on or screw-on application, preferably eight or nine helically spaced threads 43 on the inner surface of annular depending wall 32 each having respective lead openings 44 and 46. Preferably, closure threads 43 are helically spaced in a continuous relationship as shown in Figure 1A but threads 43 can alternately be discontinuous and can take on any cross-sectional profile suitable for mating with threads 24 on the container neck finish 10 during snap and screw-on application of the closure 30 to the neck finish 10.

As shown in Figure 3, depending from closure member 31 is depending annular <sup>inner annular sealing flange</sup> valve 48. Annular <sup>inner annular sealing flange</sup> valve 48 is spaced apart from annular depending closure wall 32 a distance which is represented by the difference in the radial distance between the outer surface of the annular neck finish wall 12 and the center of the circumferential opening 13 on the one hand and the radial distance between the inner surface of annular wall 12 and the center of the circumferential opening 13 on the other hand. Preferably <sup>inner annular sealing flange</sup> valve 48 includes a taper proximate to its lower edge which permits initial engagement of the <sup>inner annular sealing flange</sup> valve 48 to the inner

periphery of the neck finish 10 opening upon application of the closure 30 to the neck finish

a 10. Optionally, <sup>inner annular sealing flange</sup> ~~valve~~ 48 contains at least one and preferably a plurality of annular sealing  
a beads 54 depending from the outer surface of the closure <sup>inner annular sealing flange</sup> ~~valve~~ which are compressed against  
the inner surface of the container neck annular wall 12 to form a seal as the closure 30 is  
5 snapped onto the container neck 10. Annular sealing beads 54 also contribute to the sealing  
force of the closure disk 31 against the container neck finish 10 as beads 54 lock beneath  
corresponding flanges on the inner surface of the container neck 10 (not shown).

Optionally, sealing engagement between the closure 30 and the mating portions of the  
exterior of the container neck annular wall 12 may be further improved by including one or  
10 more annular sealing beads 55 extending around at least a portion of the interior surface of  
the closure depending annular skirt 32. In the preferred embodiment an annular sealing bead  
55 is positioned on annular wall 32 proximate of closure element 31 and is located and  
<sup>dimensioned</sup> ~~dimension~~ to engage and cooperatively secure closure 30 to an annular ring flange <sup>22</sup> or groove  
a 21 on neck finish 10 when the cap is snapped onto the neck finish 10.

15 Cap 30 when used in combination with neck finish 10 of the present invention permits  
the placement of the cap on the neck finish by snap-on or twist-on application. By preferably  
utilizing eight or nine threads 24 and 43, it is not necessary to screw the cap on or off the  
neck. However, by twisting the cap it is possible to obtain an even more secure closure when  
used by the ultimate consumer, while at the same time providing a leak proof container at  
20 the capping station without the necessity of so twisting.

While presently preferred embodiments of the invention have been shown and described in particularity, the invention may be otherwise embodied within the scope of the appended claims.